CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

SITE CLEANUP ORDER 92-132

AMENDMENT OF SITE CLEANUP ORDER NO. 91-020 AND
ADOPTION OF FINAL CLEANUP LEVELS FOR:

FMC CORPORATION, GROUND SYSTEMS DIVISION AND
FEDERAL PACIFIC ELECTRIC COMPANY

333 WEST BROKAW ROAD
SANTA CLARA
SANTA CLARA COUNTY

The California Regional Water Quality Control Board, San Francisco Bay Region (hereinafter called the Board) finds that:

1. SITE DESCRIPTION FMC Corporation (FMC) presently owns and occupies a 27 acre property located at 333 West Brokaw Road, Santa Clara, Santa Clara County (the Site), Figures 1 and 2, Appendix D.

2. SITE HISTORY Land use in the area was primarily agricultural before 1950. The property was first developed with the construction of two buildings in 1950 by Pacific Electric Manufacturing Company. Federal Electric Products Company acquired Pacific Electric in 1953 and operated the business until 1954. Federal Pacific Electric Company (FPE) purchased Federal Electric Products in 1954 and owned the property until 1964. FMC purchased the property in 1964 and FPE continued to operate onsite. FPE leased from FMC the northwesterly portion of the building and a portion of a storage yard located in the northwest corner. FPE and its predecessor companies manufactured circuit breakers, air switches and transformers until 1968. Oil filled transformer production was a subordinate contribution to the overall sales volume, between 4 and 10 percent. FMC has used since 1964, and currently uses this site, for manufacturing and assembly of military tracked vehicles.

3. REGULATORY ISSUES The Regional Water Quality Control Board, San Francisco Bay Region named FMC as a discharger when the Board adopted Site Cleanup Order 91-020 on February 20, 1991. FPE was not named in SCO 91-020 as a discharger due to incomplete information regarding FPEs contribution to site pollution. FPE later submitted a site-use history which reported the use of PCBs, mineral oil, paints and solvents, and some of these chemicals have been identified, at least PCBs, in surface soils at the site. After review of this information, it was determined that FPE and/or its predecessor companies have discharged pollutants to the surface and have thereby contributed to the site soil pollution and the polluted soil threatens to discharge to the ground water. FPE is named as a discharger in this Order amendment because of their ownership and use of the site, and discharge of chemicals to the surface between 1954 and 1968. The PCBs have not affected the site ground water but their presence threatens to create a condition of pollution.

This Site Cleanup Order Amendment finds acceptable and adopts FMC's proposed final cleanup levels for VOCs, TPH and PCBs in soil and ground water, as submitted per requirements of Board Order 91-020, and names to Board Order 91-020 with this Amendment, FPE as a second discharger. It is unnecessary under current SCO requirements for FPE to submit a separate remedial investigation report or remedial action plan. The dischargers, however, may at a later date propose alternate cleanup levels for soil or ground water. Any alternate cleanup levels for site pollution must consider State Board Resolutions 68-16 and 92-49. The dischargers are responsible for arranging cleanup agreements between them.

Both dischargers are responsible for pollution found in the soil and groundwater on the site, but it is not clear when discharges of pollutants occurred or the contribution for which each discharger may be responsible. The Board at a later date may further delineate areas of responsibility.

4. SITE INVESTIGATIONS FMC has conducted site soil and ground water investigations at the site since June, 1989. FMC submitted "Remedial Investigation Report, FMC Corporation, 333 West Brokaw Road, Santa Clara, California", April, 1991 and "Addendum to Remedial Investigation Report, FMC Corporation, 333 West Brokaw Road, Santa Clara, California", July, 1991. To date, 28 ground water monitoring wells, 74 soil gas sampling points and 117 soil boring have been used for the site's environmental assessment to develop a remedial action plan. Quarterly ground water monitoring has been ongoing since May, 1989.

The "Remedial Alternatives Report, FMC Corporation, 333 West Brokaw Road, Santa Clara, California" was submitted by FMC in September, 1991 pursuant to Provision C.1.b. of SCO 91-020. The remedial alternatives report (RAR) proposes cleanup levels for site soil and ground water pollution. FMC's "Evaluation of Soil and Ground Water Cleanup Levels, FMC Corporation, 333 West Brokaw Road, Santa Clara, California" was submitted on June 24, 1992 as a supplemental document to support the proposed cleanup levels for soil and ground water.

5. SITE POLLUTION 333 West Brokaw is partitioned into areas of concern for the remedial investigation report. The site is composed of seven surface areas labeled "Areas I-VII" and three ground water zones, labeled as "ground water operable units" (OUs; Figures 3 and 4).

A. Soil Pollution

TPH as oil and grease in surface soils is the most prevalent pollution at the site found in Areas I, II, III, V, VI and VII (Figure 3). TPH pollution is found to depths of 30 feet below the surface in three locations, but the highest TPH concentrations are found in the uppermost 15 feet of the soil column with concentrations up to 18,000 ppm. TPH pollution as oil and grease and other high boiling point compounds, is found at elevated concentrations which will require remediation in six of the seven surface areas. The TPH pollution in Area VII above the remedial action levels has been identified as being related to the asphalt concrete pavement. This asphalt-related TPH is not considered to require remediation.

PCBs are found in shallow soils at concentrations up to 15,000 ppm in Area II on the southwest side of the high bay building (Figure 3). Polychlorinated biphenyls, in general use until about 1976, were polymolecular chlorine compounds used for their insulating and cooling properties in electrical equipment and hydraulic and lubricating oils. Aroclor 1260 is the main PCB compound found in onsite shallow sediments. FPE's site-use history references Askarel 1470, in which Askarel is a generic name for PCB-containing substances. The site-use history states that Askarel 1470 was used for the filling of some completed transformers. The filling of completed transformers occurred in two areas of the site; the southeast portion of the original building until 1964 and at the high bay building between 1964 and 1968. The storage of PCB filled drums was outside in the storage yard in the northwesterly section of the property.

Four transformers, of which one was a PCB-containing transformer, were located in Area II. FMC removed the PCB transformer from service in 1985 which was replaced with a non-PCB containing transformer. PCB releases to soil in Area II related to the maintenance, repair or replacement of the PCB-containing transformer may have occurred.

The use of a PCB-containing transformer by FMC and possibly FPE, also occurred in Area II, and past PCB transformer manufacturing operations by FPE occurred in the adjacent high bay building. However, the specific source(s) of the PCBs found in Area II has not been determined. More information on historical PCB use by FMC, possibly in hydraulic oils or manufacturing processes, is necessary to evaluate the potential sources for the PCB discharges.

VOC soil pollution is found principally in Areas II and V (Figure 3). Trichloroethene (TCE) and 1,1,1-trichloroethane (TCA) are the VOCs most often detected, with DCE and DCA isomers detected less frequently. PCE has been detected in one location in Area III and freon is found occasionally. TCE is the most widespread VOC found in onsite soils with concentrations up to 4.1 ppm. TCA is less prevalent but found at higher concentrations, up to 17 ppm. The total VOC concentrations have been measured in affected areas for determining the scope of remediation necessary using a goal of 1 ppm total VOCs remaining in soil.

B. Ground Water Pollution

Ground water pollution of the A-level aquifer identified in the three OUs may be related to areas of VOC surface pollution or storm water conveyance systems (Figures 3 and 5). OU-1 has the highest concentrations of TCE, up to 1,700 ppb in onsite wells and up to 10,000 ppb in an offsite upgradient well. (The offsite source of TCE may be from an adjacent FMC property, 328 West Brokaw Road which is being cleaned up under a separate Board action.) OU-2 has TCE concentrations up to 36 ppb and OU-3 with TCE concentrations as high as 11 ppb. VOC pollution above MCLs has been found only in the A-level aquifer.

Ground water pollution in several wells of the B-level aquifer is from TCA, TCE and TPH as oil and grease. Total VOC concentrations in the B-level aquifer have been as high as 39 ppb, but individual VOC species do not exceed MCLs. TPH pollution has

been detected up to 4,800 ppb in the B-level aquifer below soil pollution Area V. However, subsequent water sampling did not confirm the presence of TPH pollution in the B-level aquifer.

6. PROPOSED CLEANUP LEVELS Analysis of the migration of pollutants remaining in soil at the proposed cleanup levels were modeled using three models: EL-Jury, an aquifer "Box Model" and MYGRT2. EL-Jury was used to predict leachate migration and transport through unsaturated soil. The aquifer box model was used to predict the mixing and dilution of the leachate with the underlying aquifer. MYGRT2 predicts the maximum ground water concentration that would occur at some downgradient point between the source area and the site boundary. The three models ultimately are used to determine what concentration of pollutants can remain in the unsaturated soil and still protect ground water.

Various remedial alternatives for soil pollution were considered for VOCs and TPHs. These alternatives ranged from no action, thermal treatment, several plans for in place soil treatment, to complete removal of and treatment of polluted soil. The remedial alternatives were evaluated based on threat to the environment, implementability, time for completion, regulatory requirements, and cost. The no action alternative was unacceptable since pollutants remain onsite, would restrict future-use options of the property, and do not protect ground water beneficial uses. Thermal destruction of pollutants is favorable because it would permanently remove pollutants from the environment, but this alternative carries prohibitive costs and would be difficult to permit locally. FMC's preferred remedial alternative, which is a combination of excavation and onsite above ground bioremediation and aeration of polluted soils was considered to be the most cost effective because there are few special requirements, FMC has available land to perform onsite treatment and this would reduce the treatment time and costs compared to in place treatment alternatives. FMC's preferred remedial alternative would protect ground water beneficial uses, the environment, and public health. Results of the modeling indicate that VOCs remaining in the soil at 1 ppm will not impact the ground water above MCLs or result in an unacceptable health risk.

Based upon consideration of FMC's remedial alternatives and State Board Resolutions Nos. 68-16 and 92-49, the Board accepts and adopts FMC's preferred remedial alternatives for the site's remediation plan for VOCs and TPH as follows.

A. Ground Water Cleanup for VOCs

The high VOC concentrations found in OU-1 warrant remedial actions. The low concentrations of VOCs found in OU-2 and OU-3 are at levels that may require remediation. The site hydrogeology, the size of plumes and the low levels of VOC concentrations in ground water OU-2 and OU-3 suggest that some reduction of water quality within the site boundaries could be acceptable and still protect beneficial uses and meet ground water objectives. Monitoring wells immediately outside of OU-2 and OU-3 plumes indicate no pollutants are in the wells and that OU-2 and OU-3 plumes are of limited lateral extent. Based on water monitoring data and modeling, water above background conditions originating from OU-2 or OU-3 would not move offsite

and should degrade and dilute onsite. Remedial actions in ground water OU-2 and OU-3 are not necessary at this time. FMC will be required to prepare a ground water monitoring and a cleanup contingency plan for VOCs in OU-2 and OU-3 that is consistent with OU-2 and OU-3 proposed remedial actions.

The ground water remedial action plan is to restore the ground waters of the state to MCLs. Due to technical difficulties using ground water extraction as a method for cleaning up aquifers to MCLs, the Board may reconsider at some future time the cleanup levels of the VOCs for ground water at OU-1, OU-2 and OU-3. The remedial plan for OU-2 and OU-3 that is also the most cost effective and will still maintain water quality at the maximum benefit to people of the state is: perform source removal in surface soils to reduce the toxicity, mobility, and volume of wastes that may cause further discharges to the ground water, and; monitor downgradient ground water conditions to assure that further pollution or nuisance does not occur. If, through a regular monitoring program it is shown that VOC concentrations are rising, then a program of extraction and hydraulic containment will be initiated by FMC to reduce the threat of movement of the pollutant plume. Cleanup actions for OU-1 and a contingency plan for OU-2 and OU-3 will be addressed during the implementation of interim remedial actions for the A-level aquifer at FMCs 328 West Brokaw site.

As a part of the cleanup, and to insure that human health and the environment is protected from water which may be less than background quality, deed restrictions on the use of the site ground water will be required until such time that is shown that concentrations of pollutants have stabilized at background conditions.

Table 1 lists the maximum VOC concentrations found in ground water Ous and the proposed cleanup levels at MCLs for the VOCs found in the site ground water. Table 1 also summarizes the proposed remedial actions for the ground water Ous of the A-level aquifer.

TABLE 1 - SUMMARY OF CLEANUP LEVELS FOR GROUND WATER

VOC	MAX CONC (ppb)	PROPOSED CLEANUP LEVELS @ MCLs (ppb)	**PREFERRED REMEDIAL ACTION**
Trichloroethene	2,000	5	Extraction of polluted ground water and treatment by use of aqueous carbon filters.(OU-1) Monitor only and/or maintain hydraulic containment in areas where there are low levels of pollutants. (OU-2 and OU-3)
Trichloroethane	190	200	
1,1-dichloroethane	6.3	5	
1,1-dichloroethylene	8.7	6	
trans and cis-dichloroethylene isomers	7.7	6 & 10	

B. Soil Cleanup

1) Cleanup of PCBs

All PCB polluted soil will be removed prior to other soil remedial actions. PCB polluted soil will be excavated to a depth where PCB concentrations are at or below 10 ppm. The 10 ppm concentration for soil cleanup is promulgated in 40 CFR §761.125(c)(4)(v) for areas of unrestricted access, such as in a residential setting and locations of unlimited public access. The EPA has determined that the 10 ppm level is protective of human health in a residential setting. 10 ppm of PCBs remaining in soil is considered a conservative cleanup level for any future property development. These soils will be containerized and shipped offsite for burial or high-temperature thermal destruction at a regulated facility.

2) Cleanup of TPH

TPH pollution soil cleanup will be accomplished by excavation and removal of soils until remaining TPH soil concentrations are at or below 100 ppm. Excavated soil will be placed in engineered stockpiles where the moisture content, nutrients and oxygen will be controlled to maintain optimum biologic activity for the bioremediation of TPH polluted soils. Soils that have undergone bioremediation will be either disposed of at a landfill or reused onsite.

3) Cleanup of VOCs

VOC polluted soil will be excavated until inplace soil concentrations are at or below 1 ppm for total VOCs. VOC polluted soils will be stockpiled in an area removed from the TPH treatment cells. These sediments will be "land farmed" to volatilize soil pollutants to reduce total VOC concentrations to 1 ppm or lower. VOC soil pollution exceeding the proposed maximum excavation depth, about 20 feet, will be remediated by soil vapor extraction.

Table 2 summarizes the proposed cleanup actions for soil and includes the estimated volume of polluted soil for cleanup in the seven polluted areas.

TABLE 2 - SUMMARY OF PROPOSED CLEANUP ACTIONS FOR SOIL

AREA	POLLUTANTS AND SOIL CLEANUP ACTIONS	SOIL VOLUME (cu yd)
I	TPH - Excavation, above ground biodegradation	70
II	PCBs - Excavation, burial or thermal destruction TPH - Excavation, above ground bioremediation VOCs - Excavation, above ground aeration, and SVE	150 550 2,000
III	TPH - Excavation, above ground bioremediation	170
IV	TPH - No action	15
V	VOCs - Excavation, above ground aeration TPH - Excavation, above ground bioremediation	20 700
VI	TPH - Excavation, above ground bioremediation	15
VII	TPH - No action	2,500
	TOTAL	6,190 cu yd

The above cleanup levels and actions are considered acceptable. The proposed remedial actions for soil cleanup is considered protective of human health and the environment and for the anticipated property development which considers unrestricted access. Cleanup levels for soil source areas are considered to be protective of potential and beneficial uses of ground water and to prevent further degradation of ground water quality.

7. HUMAN HEALTH RISKS ASSOCIATED WITH PROPOSED VOC CLEANUP LEVELS The site ground water is considered as a source of domestic water supply per Board Resolution 89-39, "Sources of Drinking Water". Table 3 lists the VOC concentrations used in the risk calculations for the ground water OUs including the respective MCL values for comparison. VOC concentrations in Table 3 are the 95th percentile upper confidence level of the VOC concentrations found in the three ground water OUs.

TABLE 3 - CURRENT VOC CONCENTRATIONS USED FOR BASELINE RISK CALCULATIONS (ppb)

CHEMICAL	OU-1	OU-2	OU-3	MCL
TCE	799.6	17.8	7.6	5
1,1,1-TCA	20.3	68.8	7.9	200
1,1,-DCE	20.6	6.4	1.8	6
cis/trans 1,2-DCE	33.5	2.4	1.5	6/10
1,1-DCA	19.6	2.8	1.5	5

EPA default parameters were used for calculating the risk values which consider ingestion, inhalation and dermal contact as the exposure pathways. Table 4 presents the risk values based on the VOC concentrations presented in Table 3. The numbers represent risks for exposure to existing ground water conditions and at proposed cleanup levels for soil.

TABLE 4 - ESTIMATED RISKS FOR SOIL CLEANUP AND EXISTING GROUND WATER CONCENTRATIONS (VOCs only)

	SOIL		GROUND WATER		
	CARCINOGENS 1 ppm (TCE only)	NON-CARCINOGENS 1 ppm 1,1-DCE only	OU-1 exst conc ingn/inhl	OU-2 exst conc ingn/inhl	OU-3 exst conc ingn/inhl
HI*	-	4.2×10^{-1}	3.9×10^{-1}	9.1×10^{-2}	2.7×10^{-2}
ECRN**	1×10^{-6}	-	3×10^{-4}	7×10^{-6}	3×10^{-6}

* HI - Hazard Index
** ECRN - Excess Cancer Risk Number
exst conc - existing concentrations
ingn/inhl - ingestion/inhalation

The HIs were calculated to evaluate risks due to exposure to both carcinogens and noncarcinogens. The ECRNs were calculated to determine the combined cancer risk of VOCs in soil and/or ground water. A suite of chemicals are considered to have insignificant adverse effects on human health when the HI is less than or equal to 1. The cancer risk number estimates the number of excess cancers that may occur in an exposed population. The Board and the EPA finds that an acceptable risk of excess cancers may be in a range between 1 excess cancer case in 10,000 to 1 excess cancer case in 1,000,000 (expressed as 1×10^{-4} to 1×10^{-6}).

The HIs at the proposed cleanup levels for soil and ground water are below unity. The HIs for existing VOC concentrations are below unity in OU-1, OU-2 and OU-3. Based on only the HIs for these areas, the proposed remedial actions are considered to be protective of human health.

ECRNs for the proposed cleanup levels for the four major areas of concern, soil and the three ground water OUs, are within the acceptable ranges of excess cancer risks. The ECRNs for OU-1, OU-2 and OU-3 are within acceptable cancer risk ranges for existing conditions of ground water pollution by VOCs. Although the ECRN value in OU-1 is within the acceptable ECRN range, the concentrations of VOCs in OU-1 exceed the MCLs and therefore requires remediation to meet Basin Plan ground water objectives. The proposed cleanup levels in OU-1 at MCLs is within the acceptable risk range and is shown to be protective of human health.

8. This action is an order to enforce the laws and regulations administered by the Board. This action is categorically exempt from the provisions of the CEQA pursuant to Section 15321 of the Resources Agency Regulations.

9. The Board has notified the dischargers and interested agencies and persons of its intent under California Water Code Section 13304 to prescribe Site Cleanup Requirements for the dischargers and has provided them with the opportunity for a public hearing and an opportunity to submit their written views and recommendations.

10. The Board, in a public meeting, heard and considered all comments pertaining to the discharge.

IT IS HEREBY ORDERED, pursuant to Section 13304 of the California Water Code, that the dischargers, successors and assignees shall cleanup and abate the effects described in SCO 91-020 and the above findings of this Order Amendment as follows:

A. PROVISIONS

1. The discharger(s) shall comply with all requirements of Order 91-020 and this Amendment by this Board action, and shall cleanup soil and ground water pollution in accordance with the cleanup levels and actions stated in Tables 1 and 2 of Finding 6 and cleanup levels stated in Findings 6.A. and 6.B. of this Order Amendment. If it is found that these cleanup levels cannot be achieved through reasonable attempts, alternate levels may be proposed by the discharger.

2. a. Final cleanup work schedules for FMC and FPE will be as approved under Provision C.1.b. of SCO 91-020 and Provisions A.1. and A.2. of this Order Amendment.

   b. FPE shall comply immediately with the following prohibitions, specifications, and provisions of Board Order No. 91-020 as specified below:
   Prohibitions: All (A.1. through A.3)
   Specifications: A.1., A.2.(only as necessary), A.3. (for FPE's remedial actions by Board approved cleanup levels)
   Provisions: C.1.d., C.2., C.3., C.4. (as applicable to FPE's remedial actions), and C.5. through C.12.

3. This Order amends Site Cleanup Order 91-020.

4. The Board will review this Order periodically and may revise the requirements as necessary.

I, Steven R. Ritchie, Executive Officer, do hereby certify that the foregoing is a full, true and correct copy of an Order adopted by the California Regional Water Quality Control Board, San Francisco Bay Region on October 21, 1992.

Steven R. Ritchie
Executive Officer